



Microbiology

TEAM WORK 435

Lecture Three

Skin and Soft Tissue Infections

Please note that some mistakes might not be ruled out.
Gently contact Microbiology.435@gmail.com if you have any question/comment.

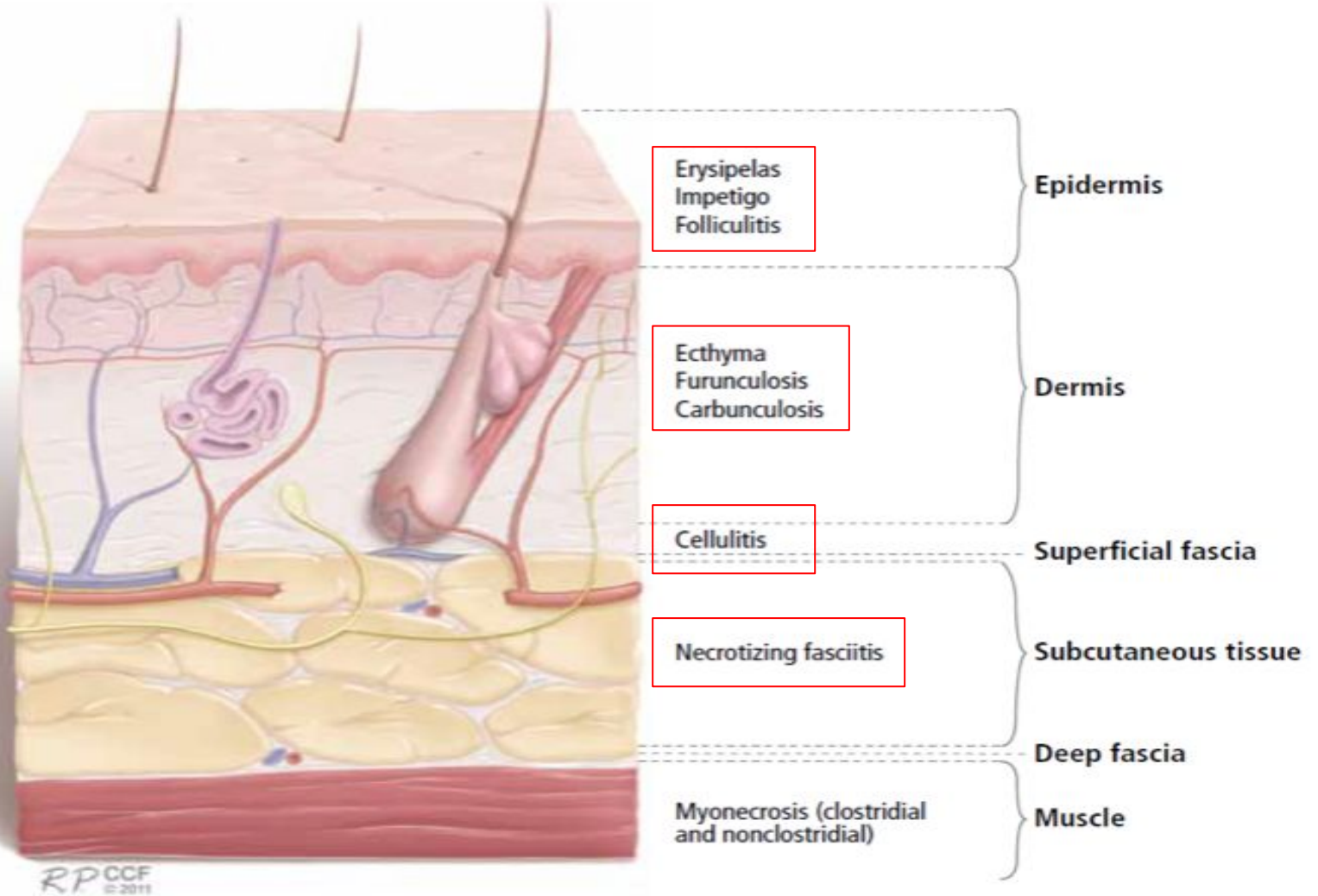
Original content
Important point
Team's note

وقل علمنا

OBJECTIVES

1. Describe the **anatomical structure** of skin and soft tissues.
2. Differentiate the various **types** of skin and soft tissue infections and their **clinical presentation**.
3. Name bacteria **commonly involved** in skin and soft tissue infections.
4. Describe the **pathogenesis** of various types of skin and soft tissue infections.
5. Recognize **specimens** that are **acceptable** and **unacceptable** for different types of skin and soft tissue infections.
6. Describe the **microscopic** and **colony morphology** and the results of differentiating bacteria isolates in addition to other **non-microbiological** investigation.
7. Discuss **antimicrobial susceptibility testing** of anaerobes including methods and **antimicrobial agents** to be tested.
8. Describe the **major approaches** to treat of skin and soft tissue infections either **medical** or **surgical**.

This image is important because it relates every disease to its location.



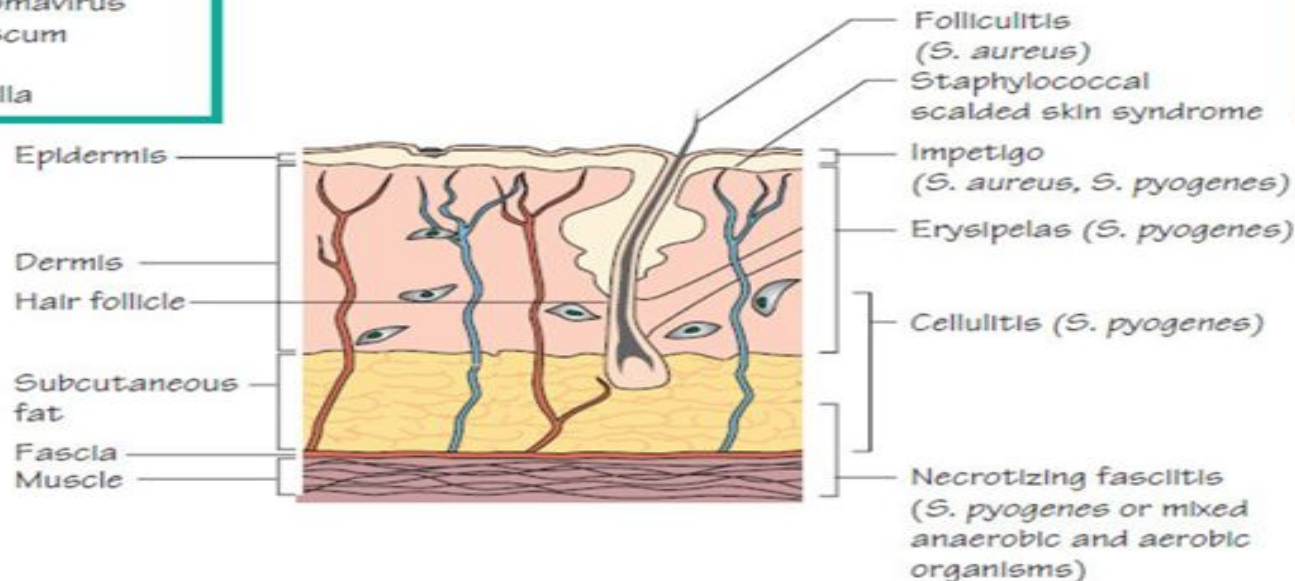
VIRAL PATHOGENS

- Herpes simplex
- Papillomavirus
- Molluscum
- Orf
- Varicella

This image summarizes the whole lecture, get back to it when you finish.

FUNGAL PATHOGENS

- Epidermophyton
- Microsporum
- Trichophyton
- Candida
- Malassezia furfur



TOXIN MEDIATED

- *S. aureus*
- Scalded skin
- Toxic shock
- *S. pyogenes*
- Scarlet fever

Bacteria

S. aureus
S. pyogenes
C. diphtheriae
M. tuberculosis
M. marinum
M. ulcerans
C. minutissimum
Pseudomonas aeruginosa
Erysipelothrix rhusiopathiae

Infection/Syndrome

Impetigo, furunculosis, boils, toxic epidermal necrolysis, acute paronychia
Cellulitis, erysipelas, impetigo
Cutaneous diphtheria
Lupus vulgaris
Chronic ulcerative disease
Destructive ulcers (Burull ulcer)
Erythrasma
Colonization of burns
Erysipeloid

Introduction

Important to know the:

- 1- Name of the syndrome
- 2- Organisms causing it
- 3- Clinical presentation
- 4- Antibiotics

- Skin and soft tissue infections are **Common**, can be **Mild-Moderate-Severe**.
- Muscle, bone, lungs or heart valves infection.
- **Staph. Aureus** and **Streptococcus** are the **most common** causative agents.
- Emerging **antibiotic resistance** among:
 - Staph. Aureus: Methicillin resistance.
 - Streptococcus Pyogenes: Erythromycin resistance.
- Generally, the treatments of these infections are **antibiotics** and/or **surgery**.
- Inflammation due to infection of the skin is called **dermatitis**.

Most of these clinical syndromes are caused by:

- 1- Streptococcus (**gram positive chains**)
- 2- Staphylococcus (**gram positive clusters**)

Impetigo (Pyoderma)

Pyoderma: any skin disease that is pyogenic (has pus).

Definition:

Common skin infection, affects **children 2–5 Years** in tropical or subtropical regions.

Caused by:

- β -hemolytic Streptococci and/or Staph. Aureus.
- **Nonbullous** Streptococcus and **Bullous** Staph. Aureus.

Characteristics:

- Consists of discrete purulent lesions.
- Exposed to areas of the body (face and extremities) and exist as skin colonization.
- Inoculation occurs by **abrasions, minor trauma, or insect bites**.
- Systemic symptoms are usually absent.
- Post-Streptococcal glomerulonephritis.
- Anti-DNAse B.

Treatment:

- **Cefazolin:** Covers **streptococcus** and **staphylococcus**.
- **If the patient has cellulitis skin infection, the first drug you must think of is **Cefazolin**.**
- Cloxacillin: Covers **staphylococcus** only.
- Erythromycin: Covers **streptococcus** only.
- Mupirocin.



What is Impetigo?

<https://www.youtube.com/watch?v=hQ9xv2cTAyw#t=18>

Anti-DNAse B:

<https://www.nlm.nih.gov/medlineplus/ency/article/00537.htm>

Post-Streptococcal Glomerulonephritis:

<https://www.nlm.nih.gov/medlineplus/ency/article/000503.htm>

The infection is very superficial in the epidermis.

The **common organism** is Staphylococcus aureus and Group A streptococcus.

Cutaneous Abscesses

Definition:

Collections of pus within the **dermis** and **deeper** skin tissues.

Characteristics:

- **Painful, tender, and fluctuant.**
- Typically polymicrobial, **Staph. Aureus** alone in 25%.
- Requires gram stain, culture, and systemic antibiotics.
- **Multiple lesions:**
 - Cutaneous gangrene.
 - Severely impaired host defenses.
 - Extensive surrounding cellulitis.
 - High fever.
 - Incision and evacuation of the pus.

Treatments:

- Most common is **surgery** (excision of abscess).
- Antibiotics: **Cloxacillin**.



Abscesses:

Accumulation of pus cells and fluid with degraded hydrolyzed tissue, yellow colored and usually smells bad.

It mainly happens in the subcutaneous tissue.

Furuncles and carbuncles

Definition:

- **Furuncles (Boils):**
 - Infections of the hair follicle (folliculitis), usually caused by **Staph. Aureus**.
 - Suppuration extends through the dermis into the subcutaneous tissue.
- **Carbuncle:**
 - Extension to involve several adjacent follicles with coalescent inflammatory mass.
 - Back of the neck especially in diabetics.
- **Larger furuncles** and **all carbuncles** require incision and drainage.
- Systemic antibiotics are usually unnecessary.



Folliculitis:

Hair follicle infection and is caused by staphylococcus aureus.

Furuncle:

Bigger Folliculitis.
(Something like a smooth boil, it is tender).

Carbuncle:

Collection of Furuncles.

So, folliculitis, furuncle and carbuncle are infections of hair follicle due to obstruction.

- Team 434 -

Outbreaks of furunculosis:

- Caused by **MSSA** and **MRSA** via:
 - Families, prisons, sports teams.
 - Hygiene.
 - Repeated attacks of furunculosis.
 - Presence of Staph. Aureus in the anterior nares 20-40%.
 - Mupirocin ointment eradicate staphylococcal carriage nasal colonization.

Staph. Aureus is the most common gram +ve cocci, and is divided into two classes (**MSSA** & **MRSA**) based on its sensitivity to methicillin.

When we add methicillin, Staph. Aureus either respond (**Sensitive**) or resist (**Resistant**).

Erysipelas and Cellulitis

- Diffuse spreading skin infections, excluding infections associated with underlying suppurative foci.
- Most of the infections arise from Streptococci, often group A, but also from other groups, such as B, C, or G.

1- Erysipelas:

- Affects the upper dermis.
- Red, tender, **demarcated**, painful plaque.
- Occurs in Infants and young children.
- **Caused by:**
 - **β -hemolytic streptococci** group A or *S. pyogenes*.
- **Treated by:**
 - Penicillin (IV or oral).



Erysipelas in the whole epidermis and dermis and it is caused mainly by group A streptococci.

IMPORTANT QUESTIONS

Q1: Describe the lesion seen in the picture.
Redness/swelling (edema)/ the margin is well demarcated.

Q2: what is the most common organism?
Group A streptococci.
(If it was abscess.. then it is staph.)

Q3: What is the drug of choice?
Penicillin.

2- Cellulitis:

- **Acute** spreading infection involves the deeper dermis and subcutaneous tissues.
- **Caused by:**
 - β -hemolytic streptococci, Group A Streptococci, and group B Streptococci: in diabetics.
 - **Staph. Aureus**: Commonly causes cellulitis by penetrating trauma.
 - **Haemophilus influenzae**: Periorbital cellulitis in children.
- **Risk factors:**
 - Obesity, Venous insufficiency, Lymphatic obstruction (operations), Preexisting skin infections, Ulceration, or eczema.
- **Diagnosis:**
 - Clinical diagnosis Symptoms and Signs.
 - High WBC's.
 - Blood culture is rarely needed.
 - Aspiration and biopsy might be needed in:
Diabetes mellitus, malignancy, animal bites, neutropenia (*Pseudomonas aeruginosa*), immunodeficiency, obesity and renal failure.
- **Observe for progression to severe infection:**
Increased in size with systemic manifestation ie. fever, leukocytosis.



Cont...

- **Treatment:**
 - Must cover Streptococcus and Staphylococcus.
 - Penicillin: For group A Streptococci.
 - Cloxacillin: For staph. Aureus.
 - **Cefazolin (cephalexin)**.
 - Clindamycin.
 - Vancomycin or linezolid: **For MRSA**.
 - Clindamycin, TMP-SMZ: **For Ca-MRSA**.
- **CA-MRSA (Community Associated MRSA) characteristics:**
 - Carry Panton-Valentine leukocidin gene.
 - More sensitive to antibiotics.
 - Can lead to severe skin and soft tissue infection or septic shock.

Extra information:

Cellulitis is associated with bacteremia, and when we say bacteremia we mean that the organism is going deeper and affecting your veins which could cause sepsis. Sepsis is the presence of bacteria and their toxins due to an infection in the wound

Treatment in general:

1- **Group A:** Penicillin

2- **If we don't know whether it's group A to B or staph:**

First generation cephalosporins (cephalexin) because it covers both staph and strept.

3- **If it was Staphylococcus aureus:** Cloxacillin

	Erysipelas	Cellulitis (Acute spreading)
Affects	The Upper Dermis (Epidermis) (Raised-clear Line Of Demarcation)	The Deeper Dermis And Subcutaneous Tissues
Caused by	<ul style="list-style-type: none"> - B-hemolytic Streptococci (Group A) - S. Pyogenes 	<ul style="list-style-type: none"> - B-hemolytic Streptococci (A&b-diabetics) - S. Aureus : Commonly Causes Cellulitis - Haemophilus Influenzae in Children
	Well Demarcated, Edematous.	Not Demarcated
Affects	Infants, Young Children	All Ages
Clinical presentation	<u>VERY RED, Tender, Painful Plaque</u>	Tenderness And Redness That Spreads To Adjacent Sk
Treatment	Penicillin: IV Or Oral	Penicillin, Cloxacillin, Cefazolin (cephalexin)

Basically, the most important things you must know so far is that:

- 1- **Impetigo and the rest of diseases** are caused by both staphylococcus aureus and streptococcus.
- 2- **Folliculitis** is caused by staphylococcus aureus.
- 3- **Erysipelas** is caused by Group A streptococci. (This group could cause sore throat and pharyngitis).

Necrotizing fasciitis

Definition:

- It is a **rare** deep skin and subcutaneous tissues infection.
- Deep inflammation of the fascia, it is systemic, very serious and kills the patient.
- Occurs at the arm, leg, abdominal wall.
- **The most serious infection in microbiology.**
- Sometimes they present as **cellulitis**.
- Usually happens to diabetic patients.

Divided to:

- **Polymicrobial (Type 1)** caused by: **Streptococcus (group A) AND Clostridium perfringens.**
- **Monomicrobial (Type 2)** caused by: **Streptococcus (group A) ONLY.**

Caused by:

- Fournier's gangrene (testicular).
- Group A streptococcus (Streptococcus pyogenes).
- Staphylococcus aureus or **CA-MRSA**.
- Clostridium perfringens (gas in tissues).
- Bacteroides fragilis.
- Vibrio vulnificus (**liver function**).
- Gram-negative bacteria (synergy): E. coli, Klebsiella, Pseudomonas.
- Fungi.

How can we differentiate between this infection and Cellulitis?

In Necrotizing fasciitis, the patient has **severe pain**. The leg is the place where the redness, not overall the body, and the patient feels heaviness in the leg infected.

it's a must that there's **question in the exam** about fasciitis; why? Because it's a very serious infection.

Polymicrobial: Mixed organism.

Monomicrobial: One organism.

Streptococci group A:

Lead to necrotizing fasciitis.

Clostridium perfringens:

Lead to gas gangrene.



Risk factors:

- Immunosuppression.
- Chronic diseases: Diabetes, liver and kidney diseases, malignancy.
- Trauma: Laceration, cut, abrasion, contusion, burn, bite, subcutaneous injection, operative incision.
- Recent viral infection rash (chickenpox).
- Steroids, Alcoholism, Malnutrition, Idiopathic.

Pathophysiology:

- Destruction of skin and muscle by releasing toxins.
- Streptococcal pyogenic exotoxins.
- Superantigen:
 - Non-specific activation of **T-cells**.
 - Overproduction of **cytokines**.
 - Severe **systemic illness** (Toxic shock syndrome).

Signs and Symptoms:

- Rapid progression of severe pain with fever, chills, Swelling, redness, hotness, blister, **gas formation, gangrene necrosis**, diarrhea and vomiting.
- **Shock organ failure**.

Diagnosis:

- A delay in diagnosis is associated with a **grave prognosis** and increased mortality.
- **Mortality as high as 73% if untreated.**
- High clinical index of suspicion.
- **Blood tests:**
 - CBC-WBC, differential, ESR.
 - BUN (Blood Urea Nitrogen).
- **Surgery debridement:** A
 - Amputation.
- **Radiographic studies:**
 - X-rays : subcutaneous gases.
 - Doppler CT or MRI.
- **Microbiology:**
 - Culture and Gram's stain: Blood, tissue, pus aspirate.
 - Susceptibility tests.

Treatment:

- Clinically suspected patient needs to be **hospitalized** OR require admission to **ICU (Intensive Care Unit)**.
- Start **intravenous antibiotics** immediately.
- Antibiotic selection based on bacteria suspected.
- Broad spectrum antibiotic combinations against:
 - Methicillin **Resistant** Staph. Aureus (**MRSA**).
 - **Anaerobic** bacteria.
 - Gram-negative and gram-positive **bacilli**.

Surgeon consultation:

- Extensive **debridement** of necrotic tissue and collection of tissue samples.
- **Can reduce morbidity and mortality**.

Antibiotics combinations:

- **Penicillin / Clindamycin / Gentamicin**.
 - (Given together, and they're the most important).
- Ampicillin / Sulbactam.
- Cefazolin / Metronidazole.
- Piperacillin / Tazobactam.
- Penicillin G. for Clostridium perfringens.
- **Hyperbaric oxygen therapy (HBO) treatment**.

What is HBO treatment?

<https://www.youtube.com/watch?v=tuRCq4nyn2Y>

The role of surgery more important than antibiotics, why?

There's necrotic tissue with no blood supply, so if you give antibiotic, no matter how strong the antibiotic is, it'll not reach because there's no blood supply, also, the huge volume of bacteria makes the mission more difficult.

Why do we add clindamycin to Penicillin for treatment for fasciitis?

1. Because it works on the ribosome > which lead to protein inhibit > which lead to stop proliferation of bacteria and inhibit the toxin.
2. Mood of action > when the bacteria growth fast and in huge number the penicillin works better (in the beginning hours), but when the bacteria slow in growth and the number is fixed the clindamycin work better (after a day or two).
3. Because the clindamycin won't stay half a minute in the blood it goes directly to the tissue.

Study smart... Read this table.

Epidemiology	Common Pathogen(s)	Therapy
Cat/Dog Bites	Pasteurella multocida; Capnocytophaga	Amox/clav (Doxy; FQ or SXT + Clinda)
Human bites	Mixed flora eikenella corrodens	Hand Surgeon; ATB as above
Freshwater injury	Aeromonas	FQ; Broad Spectrum Beta-lactam
Saltwater injury (warm)	Vibrio vulnificus	FQ; Ceftazidime
Thorn, Moss	sporothrix schenckii	Potassium iodine
Meat-packing	Erysipelothrix	Penicillin
Cotton sorters	Anthrax	Penicillin
Cat scratch	Bartonella	Azithromycin

Pyomyositis

Definition:

Acute bacterial infection of skeletal muscle, usually caused by Staph. Aureus.

Characteristics:

- No predisposing penetrating wound, vascular insufficiency, or contiguous infection.
- Most cases occur in the tropics.
- 60% of cases outside of **tropics** have predisposing **RISK FACTOR**:
 - Diabetes mellitus, Ethyl Alcohol, liver disease, steroid Prescription, HIV, hematologic malignancy.

History:

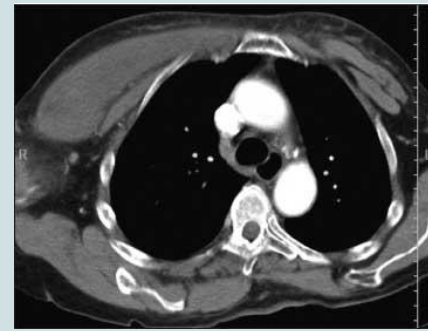
- Blunt trauma or vigorous exercise (50%), then period of **swelling without pain**.
- 10-21 days later, pain, tenderness, swelling and fever.
- Pus can be aspirated from muscle.
- 3rd stage: sepsis, later metastatic abscesses if untreated.

Diagnosis:

X-ray, US, MRI or CT.

Treatment:

Surgical drainage and antibiotics.



Study smart... [Read this slide.](#)

Summary:

- Most commonly caused by *Staphylococcus aureus* and *Streptococcus pyogenes*.
- Risk factors for developing SSTIs include breakdown of the epidermis, surgical procedures, crowding, comorbidities, venous stasis, lymphedema.
- Most of the infection are mild and can be managed on an outpatient basis.
- Most SSTIs can be managed on an outpatient basis, although patients with evidence of rapidly progressive infection, high fevers, or other signs of systemic inflammatory response should be monitored in the hospital setting.
- Superficial SSTIs typically do not require systemic antibiotic treatment and can be managed with topical antibiotic agents, heat packs, or incision and drainage.
- Systemic antibiotic agents that provide coverage for both *Staphylococcus aureus* and *Streptococcus pyogenes* are most commonly used as empiric therapy for both uncomplicated and complicated deeper infections.

Great job, now take an online quiz:

<https://www.onlineexambuilder.com/skin-and-soft-tissue-infections/exam-51006>

MALES

Leader: Ali Alzahrani

- Khalid Sharahily
- Ahmad Alzahrani
- Zayed Alsalem
- Muhammad Dossary
- Meshal Alhazmy
- Hamza Alfjar

FEMALES

Leader: Sara Alenezy

- Nojood Alhaidri
- Alanoud Alsalman
- Noura AlTawil
- Nurah Alqahtani

Microbiology

TEAM WORK⁴³⁵
DREAM BUILDERS



“Don’t follow your dreams; chase them.”

Please note that some mistakes might not be ruled out.
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